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Purpose/Objective: Volumetric Modulated Arc Therapy (VMAT) is increasingly popular as a treatment method in radiotherapy due to the speed with which treatments can be delivered. However, there has been little investigation into the effect of increased modulation in lung plans with regard to inter-fraction organ motion. This is most likely to occur where the planning target volume (PTV) lies within areas of low density. This study aims to investigate the effect of modulation on the dose distribution using simulated patient movement, and to propose a method which is less susceptible to such movement.
Materials and Methods: Simulated inter-fraction motion is achieved by moving the plan isocentre in steps of 0.5cm and 1.0cm in 6 directions, for 5 clinical VMAT patients. The proposed planning method involves optimising using a density override to 1g/cm^3, within the PTV in lung, to reduce segments boosting the periphery of the PTV.
Results: This investigation shows that modulation can result in an increase in maximum dose of more than 25%, an increase in PTV D2 of 17% and a reduction in D98 by 46%. Unacceptable organ at risk (OAR) doses are also seen. The proposed method reduces modulation, resulting in a maximum dose increase of 10%.
Conclusions: Whilst safeguards are in place to prevent increased dose to OARs from patient movement, there is nothing to prevent increased dose as a result of modulation in lung. A simple planning method is proposed to safeguard against this effect. Investigation suggests that where modulation exists in a plan this method reduces it and is clinically viable.

EP-1232
Determination of optimal value of leaf motion constraint parameter for volumetric modulated arc therapy plans

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Purpose/Objective: To study the effect of Leaf Motion Constraints on the quality and delivery of Volumetric-modulated arc therapy (VMAT) plans. To determine a single optimal value of Leaf Motion Constraint Factor in Oncentra Master Plan Treatment Planning System for optimizing the balance between plan quality and delivery efficiency for VMAT Treatments.
Materials and Methods: Eight patients undergoing treatment in our institution were selected for this study, 2 Carcinoma of Cervix, 2 Head and Neck, 2 Stomach and 2 Prostate patients. For each patient, VMAT plans were generated with the planning CT scan with different LMC values ranging from 0.1 to 30 mm/deg. The treatment plans for each category were designed to deliver the dose to the planning target volume as per the standard hospital protocol. The Objectives for the Plans were the coverage of 95% of the PTV with the prescribed dose. Planning Objectives were placed to ensure that no more than 1% of the PTV will receive more than 107%. Planning objectives were also placed for normal structures as per the hospital protocol. Dose-volume histograms (DVH) for the target volume and the respective organs at risk were compared.
Results: The use of a more restrictive leaf motion constraint less than 4 mm/deg results in inferior plan quality. A less restrictive leaf motion constraint greater than 6mm/deg results in improved plan quality but can lead to less accurate dose distribution as evidenced by increasing discrepancies between the planned and the delivered doses. The Value of 5 mm/deg proved to give acceptable plan quality for different anatomical sites without sufficient discrepancy between planned and delivered dose.
Conclusions: The leaf motion constraint ensures the delivery of the optimized plan, but it also impacts the plan quality, the delivery accuracy, and the delivery efficiency. Our studies indicate that a leaf motion constraint of 5 mm/deg for LMC can provide an optimal balance between plan quality, delivery accuracy, and efficiency. The effect of LMC value on dose to target and normal structures, treatment delivery time, Gamma Value and Treatment Monitor Units are also discussed and reported.

EP-1233
The influence of selection of the optimization parameters for automatic beam angle optimization

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Purpose/Objective: The intensity modulated radiotherapy (IMRT) is commonly used in many clinical cases and its application is still growing. Planning process is complex and time consuming. The quality of IMRT plans depends on beam angle selection, number of beams and on planners experience or intuition. Beam Angle Optimization (BAO) is an automated treatment planning tool for selecting the suitable beam angles based on user defined Dose Volume (DV) objectives that speeds up the planning process for IMRT treatments. The BAO algorithm has a lot of initials parameters which are quite difficult to set default values. The aim was to find compromise between dose distributions and optimization time with respect to optimization parameters selection for automatic beam angle algorithm.
Materials and Methods: The evaluation was undertaken for 5 complex H&N cancer patients. The 9 BAO plans were prepared for each patient. The Plan Geometry Optimization (PGO) was performed in two modes: global and local. The first one is based on the DV objectives defined by user, starts with user definable initial number of fields. The second one continues from the results of the global optimization by fine-tuning the field parameters such as collimator or gantry angles. The BAO algorithm was allowed to search up to 50, 100 or 200 different initial sets of beams in a coplanar field geometry. For each of them, the local optimization was performed with 50, 100 and 200 iterations. The final number of beams was defined between 5 and 10. The optimization objectives and DV constraints were the same for each plan. Eclipse (10.0.34) treatment planning system was used during this study. The dose distribution was calculated using analytical anisotropic algorithm (AAA). The analysis was carried out for DVH for target structures and organs at risk (OARs) and for optimization time.
Results: Comparison of DVHs, obtained with use of different optimization, showed the dose distributions with a similar quality. There was no difference for target coverage (D2% and D98%). The DVHs for parotid glands and brain steam are also similar for all 9 plans. There were observed some differences for DVHs for spinal cord, however no relationship with selected parameters was found. The plans with 50 iterations of local optimization were finished in about 2,5 – 3 h, with 100 iterations in about 4 – 5 h and with 200 iterations in about 8 h. The initial beam numbers has got very small influence on time of the calculation.
Conclusions: The idea of PGO algorithm was to improve and speeds up the planning process for IMRT. The study showed no difference in DVHs with respect to optimization parameters selection. The calculations of treatment plans were time consuming, because of 32-bit algorithm architecture. The shortest calculations were with use of 50 iterations of local optimization. On the basis of the study the default values of initial parameters for BAO were established. BAO method may be used by planners with lower experience in IMRT planning.

ELECTRONIC POSTER: PHYSICS TRACK: RADIOBIOLOGICAL MODELLING

EP-1234
Application for the registration of patient response to RT

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Purpose/Objective: Documentation of patient response to radiation therapy (RT) using international guidelines of classification of side-effects is rarely made by busy radiation oncologists.This highly limits the number of radiobiological studies that could be made otherwise. Digital medical systems are being developed worldwide but efficient tools integrating the specific RT needs are lacking. A software for the registration of patient response to the treatment during the RT medical appointment will be described.
Materials and Methods: The software was developed in Matlab and data storage is made using a PostGreSQL database. The workflow starts by introducing a new patient in the database by the radiation oncologist. Patient identification and basic disease and treatment parameters need then to be defined. Based on the selected options the appropriate guidelines of classification of complications for that pathology are displayed. Once a new follow-up appointment is inserted the user may start documenting patient response to RT. Different areas were built for the registration of observed complications and disease evolution to the prescribed protocol. For software development and testing the pathology of head and neck tumours, using the RTOG/EORTCguidelines, was first selected.
Results: This platform is being used clinically since the middle of 2011. Since then data from 285patients during more than 2200